Abstracts from the Vog Symposium

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Vog Overview and Background

Volcanic emissions from the Kilauea East Rift Zone are causing the most obvious air pollution problem in Hawaii today. On *Kona wind* days, volcanic haze is clearly visible hundreds of miles away on Oahu. The characteristics and dispersion patterns of volcanic emissions have been well-defined; however, studies on possible health effects are inconclusive.

Kilauea East Rift Zone has been erupting almost continually since January, 1983. Everyday the volcano produces more than 1,000 tons of sulfur dioxide. In fact, the U.S. Environmental Protection Agency reports the only recent violations of air quality standards for sulfur dioxide in the region were the result of naturally occurring volcanic emissions at the Hawaii Volcanoes National Park ("Breathing Easier: a Report by EPA on Air Quality in California, Arizona, Nevada and Hawaii").

Air quality monitoring data from other areas on the Big Island are very limited; however, data collected by the Department of Health suggest that state and federal ambient air quality standards are not being exceeded in Kona or other areas of the Big Island even under the worst conditions. Nevertheless, sulfur dioxide, fine particles in the air, and various pollutant mixtures, such as sulfates and acid aerosols may individually or in combination present a significant risk.

Of special interest is the possibility that sulfur dioxide and other sulfur compounds are combining with oxygen and water to form sulfuric acid mists. These acid mists can irritate the respiratory tracts of humans and animals. At present, there are no air quality standards to judge the degree of health risks posed by these pollutant mixtures.

Since 1983, the Department of Health has received hundreds of calls from residents and visitors concerned about respiratory problems associated with exposure to volcanic emissions (vog). Anecdotal reports by doctors also support the contention that these pollutants may affect breathing and aggravate existing chronic respiratory and cardiovascular diseases. Sensitive individuals may include asthmatics, individuals with bronchitis or emphysema, possibly children, and the elderly. Unfortunately, existing records have been found to be incomplete and inadequate to characterize health risks. Thus, studies completed to date have been largely inconclusive.

This special issue of the *Hawaii Medical Journal* includes abstracts of recent air quality and health studies conducted on vog, and they represent the current state of understanding of the subject. Although studies on health risks to date are inconclusive, all involved in the symposium agreed that further work is needed to better characterize health risks.

Obviously, nothing practical can be done to mitigate the source; however, it is important that the Department of Health and other agencies further define current risks so that appropriate intervention strategies can be developed. With a firm scientific foundation, we will be in a much better position to address public health concerns associated with vog.

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Airflow Over the Island of Hawaii

Pertubations induced by the airflow past single isolated mountains include a variety of phenomena: flow splitting and flow deceleration on the windward side, mountain wakes in the lee side, etc. In addition, the airflow is affected by the diurnal heating cycle. From July 11 to August 24, 1990, the Hawaiian Rainband Project (HaRP) was conducted over the island of Hawaii to study the mesoscale airflow around the island, and the dynamics of early morning rainbands offshore of Hilo. The mesoscale airflow over the island summarized in this report is based on the data collected from surface stations and aircraft observations during HaRP.

Island blocking as revealed by the mean surface airflow

The mean trade-wind sounding taken by aircraft over the ocean east of Hilo during HaRP exhibits east-northeast trade winds on the order of 6 to 9 meters per second. Along the windward coast, flow splitting occurs in the Hilo Bay area. The airflow moves around the island with northeasterlies along the northeastern coast and southeasterlies along the northeastern coast. In addition to northern and southern tips of the island, strong surface winds also are found in the Humuula Saddle between Mauna Loa and Mauna Kea and in the Waimea Saddle between the Kohala Mountains and Mauna Kea. In both regions, the airflow moves around the mountains and channels through the saddle. On the windward slope, the incoming flow is decelerated significantly as it approaches the island. In the lee side, the trade winds are completely blocked by Mauna Kea and Mauna Loa with calm winds.

Nighttime and daytime flow regimes

The surface airflow is strongly modulated by the diurnal heating cycle. At night, much of the island has a downslope wind component except in the high wind regions: northern tip, southern tip, Waimea Saddle, and Humuula Saddle. The flow direction along the northeastern and southeastern coasts shows that the trade winds are being forced to move around the island.

On the windward slopes west of Hilo, on the Kona coast and along the Waikoloa coast downstream of the Waimea Saddle, the wind direction of the daytime flow regime is about 180° out of phase with